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CHANGING OF THE SILICA POROUS STRUCTURE UNDER THE INFLUENCE OF PULSING MAGNETIC FIELD

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Textural characteristics of silica obtained from the gels have been introduced, which were formed in a pulsing magnetic field. It is shown, that all the characteristics of the resulting silica porosity, especially the pore distribution according to the size, essentially depend on the frequency of the magnetic field. It has been suggested that in dilute gels of the polysilitic acids pseudo-mesophase aggregate systems may be formed, which similar to liquid crystaline structures are capable of restructuring under the influence of weak electromagnetic fields.

***Keywords*:** alternating magnetic field, silica, mesophase system, GAB and Aranovich isotherms adsorption equations.

Introduction. The influence of the magnetic field on humans, animals, plants and chemical reactions has been known for a long time [1]. However, in the literature so far there are no more or less well grounded explanations of that influence mechanisms. One of its main reasons is the lack of consensus concerning the characteristics of the medium subject to direct measurement, which can be most essentially altered under the influence of magnetic field. As such a parameter of the investigated solutions, electric conductivity, density, surface tension, etc. are used most frequently. However, because of the minor magnitude of the observed changes none of these methods is generally acceptable up to now.

Taking into account the fact, that textural parameters of silica gels, obtained by means of sol-gel method, are highly dependent on the dispersion media composition and the conditions of gel formation are extremely sensitive to their changes [2], we have studied the silica porous structure parameters, gels-precursors, which were formed in magnetic fields of various frequency.

Materials and Methods. The Sol of the polisilicic acid has been obtained from sodium methasilica (with module SiO_2:Na_2O=1:1) in hydrochloric acid medium at pH 6–8 with an estimated concentration of silicic acid of 0.05 *mol*/*L*. Gel formation of polisilica acid has been carried out in the cell of specially constructed for these investigations generator of alternating magnetic field with the voltage of approximately 10 *Gauss* within 15 *h* without mixing. The resulting gels

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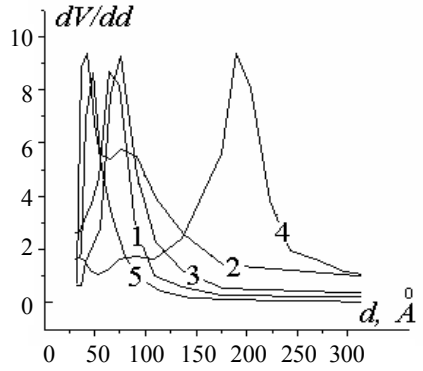
have been washed with distilled water, dried at 120^0C for 2 *h* and then calcined at 500^0C for an hour. To ensure the greatest accuracy and repeatability of the results of estimations the textural parameters of the derived silica gels have been identified by adsorption isotherms of various adsorptives at 20^0C, applying the equations of adsorption isotherms of GAB and Aranovich by method [3, 4].

Results and Discussion. As may be concluded from the data presented in the Table and Figure, the textural characteristics of the obtained silica gels significantly differ from each other. As compared with the sample 1, the gel-precursor of which was obtained outside the cell of magnetic field generator, this is especially emphasized in the samples, obtained in the magnetic fields with frequencies of 40 and 50 *Hz* respectively. Whereas at 50 *Hz* over the specific surface (S_{sp}) of silica as compared with the sample 1 increases up to 75%, in case of 40 *Hz* it, on the contrary, decreases to 35%. The sample, gel-precursor of which was obtained in the magnetic field with frequency of 40 *Hz* also dramatically differs by specific adsorption volume as well as by the location of maximum on the curve of pore distribution by size.



Pore distribution by diameters.
1 – comparative silica;
2–5 – silica obtained in the magnetic field with a frequency of 20, 30, 40 and 50 *Hz* respectively.

Texture parameters of silica

S_{sp}, by various adsorptives, m^2/g						V_{Nome}, by benzene, cm^3/g	d_{max}, *Å*	Fractal dimension, *D*
Frequency of magnetic field, *Hz*	N_2 16.2 *Å*^{2}	$CHCl_3$ 28.5 *Å*^{2}	C_6H_6 41 *Å*^{2}	C_6H_{14} 51.5 *Å*^{2}	C_9H_{12} 62.3 *Å*^{2}			
0	200	195	192	188	185	0.452	76	2.112
20	205	185	172	165	158	0.560	55; 90	2.380
30	190	178	170	164	160	0.479	80	2.256
40	130	125	120	120	120	0.250	210	2.131
50	450	375	335	310	290	0.433	40	2.650
60	215	207	205	200	195	470	180	2.133

The obtained data in comparison with the results presented in [5], confirm that unlike the concentrated hydro-gels of polisilica acid, in which cyclic oligomer particles are mainly dominated, the structure of which is resistant enough to external influences, in dilute gels oligo of silicic acid apparently form both open circuits in the form of three-dimensional spirals and the chains with multiple branches. In such gels pseudo mesophatic aggregate system is formed, which, similar to liquid crystal structures, is capable of transformation under the influence of weak electromagnetic fields.

Thus, it may be argued that weak electro-magnetic fields can be used as one of the parameters for various system synthesis according to Sol-Gel technology in general and silica, in particular.

Comprehensive study of this influence mechanism, discovered for the first time, may support the solution of the issue of weak influence effect, magnetic fields in particular on different chemical and biological systems.

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